



Instruction Book

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- Navy Type ACB
600 Frame Size
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- AIR CIRCUIT BREAKER
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- Westinghouse Type DBN-40S
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- Direct Current Air Circuit Breaker
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- Bureau of Ships
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- Navy Department
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- Preliminary Instructions
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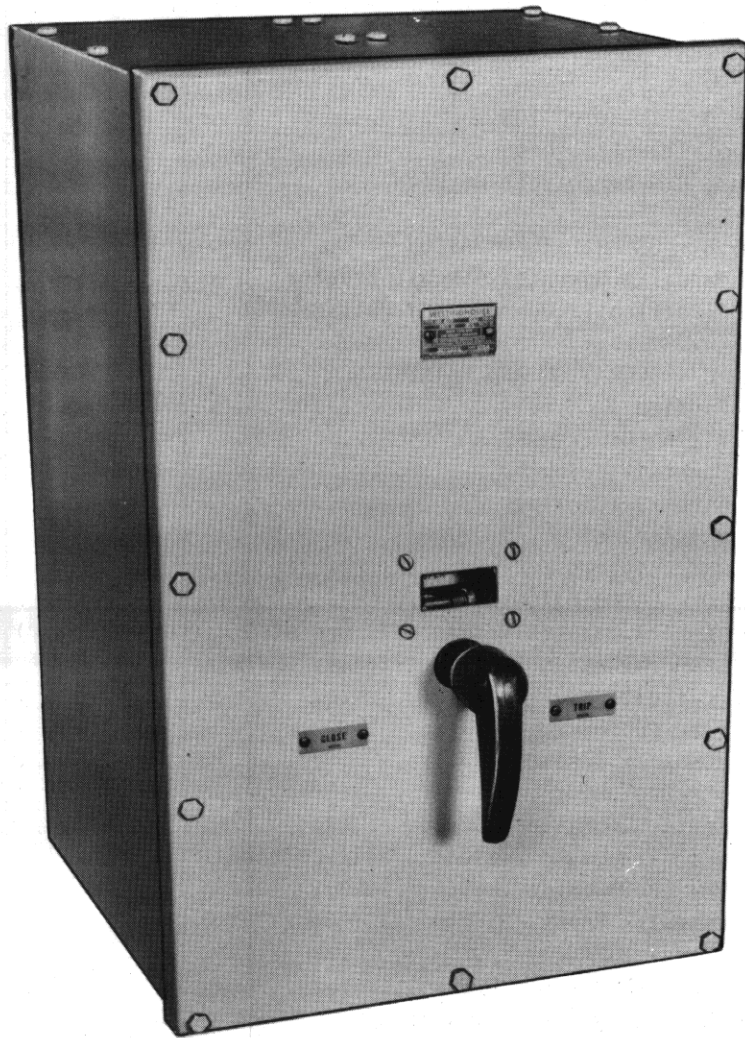
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INDEX

AIR CIRCUIT BREAKER
Navy Type ACB (Westinghouse Type DBN-40S)
600 Frame Size
(Special Interrupting Rating - See Page 4)

<u>Description</u>	<u>Page</u>
SECTION A - INTRODUCTION	1
List of Illustrations	1
Circuit Breaker Dimension Plan	1
SECTION B - GENERAL INFORMATION	2
B-1. Manually Operated Circuit Breaker	2
B-2. Electrically Operated Circuit Breaker	3
SECTION C - OPERATION AND MAINTENANCE	4
C-1. Caution	4
C-2. Wiring Diagrams	4
C-3. Shunt Tripping	4
C-4. Electric Closing	4
C-5. Maintenance	4
SECTION D - DESCRIPTION OF COMPONENTS AND ATTACHMENTS	5
D-1. General Assembly (Manually Operated Circuit Breaker)	5
D-2. General Assembly (Electrically Operated Circuit Breaker)	5
D-3. Arc Chutes	5
D-4. Contact Assembly	5
D-5. Mechanism	7
D-6. Anti-Shock-Close Device	9
D-7. Closing Magnet (Electrically Operated Circuit Breaker)	10
D-8. Closing Relay (Electrically Operated Circuit Breaker)	11
D-9. Anti-Shock-Open Device	14
D-10. Series Overcurrent Trip Device	15
D-11. Auxiliary Switch	16
D-12. Shunt Trip Device	17
D-13. Repair Parts	17

AIR CIRCUIT BREAKER



343988



NAVY TYPE ACB AIR CIRCUIT BREAKER Westinghouse Type DBN-40S

SECTION A - INTRODUCTION

A-1. LIST OF ILLUSTRATIONS

<u>Fig. No.</u>	<u>Westinghouse Ref. Dwg.</u>	<u>Title</u>	<u>Page</u>
...	Photo #343988	Frontispiece
1	32-B-5808	Outline Dimensions	19
2	46-A-8536	General Assembly	20
3	18-C-7218	Wiring Diagrams	21
4	38-A-9840	Arc Chute and Contact Assembly	22
5	47-A-1580	Mechanism	23
6	22-B-1624	Anti-Shock-Close Device . .	24
7	31-A-2610	Closing Magnet	25
8	46-A-8539	Closing Relay	26
9	22-B-1622	Anti-Shock-Open Device . . .	27
10A	47-A-1579	Series Overcurrent Trip Device	28
10B	362408)	Overcurrent Tripping Curve .	29
10C	362409)	Overcurrent Tripping Curve .	30
11	32-A-6819	Auxiliary Switch	31
12	22-B-1625	Shunt Trip Device	32

A-2. CIRCUIT BREAKER DIMENSION PLAN

Figure 1 gives the outline dimensions for the Navy type ACB 600 frame size air circuit breaker, Westinghouse Corporation Type DBN-40S direct current breaker in enclosure.

AIR CIRCUIT BREAKER

SECTION B - GENERAL INFORMATION

B-1. MANUALLY OPERATED CIRCUIT BREAKER

The DBN-40S air circuit breaker is a sturdy, compact piece of shipboard electrical equipment consisting of a rigid steel chassis to which are bolted the several sub-assemblies which make up the complete circuit breaker. For example, the mechanism, pole units, arc chutes, over-current trip devices and other attachments are each complete within themselves and are readily interchangeable between breakers. They may be removed intact and replaced if necessary with minimum outage time.

The DBN-40S is a type ACB air circuit breaker of 600 frame size. Its interrupting and continuous current ratings are as outlined in the following table:

Interrupting Rating

355 VOLTS D-C
100,000 AMPERES*

*Non-inductive circuit as demonstrated in test at New York Naval Laboratories under Project 5258-18

Continuous Current Rating

<u>Circuit Breaker Copper Rating Amperes</u>	<u>Overcurrent Trip Coil Rating Amperes</u>
1200	640
	900

The chassis of the air circuit breaker consists of a rigid steel panel (150) Fig. 2 on the front of which is bolted a supporting frame consisting of a bracket (151) which in turn supports shelf (152). A separate pole unit (100) is bolted to the steel panel for each pole. The base of each pole unit is molded from insulating material. When supplied, the series overcurrent trip devices (400) are bolted to the lower part of the pole unit base. The moving contact assembly is pivoted at its lower end on the pole unit base and is connected to the lower stud either directly or through a series overcurrent trip device. The stationary contact assembly is connected directly to the upper stud. The moving contact assembly opens and closes the electric circuit by moving out and in from the stationary contact assembly. An arc chute is mounted above and surrounding each pair of contacts. Its purpose is to stretch and cool the arc drawn when the contacts separate so that it may be readily extinguished.

The operating mechanism (200) is located on the breaker shelf (152) and transmits the force for closing the breaker from the operating handle (166) to the cross bar (168) and thence to the moving contact assembly through insulating links. The mechanism then latches and holds the contacts in the closed position. The circuit breaker is closed manually by releasing latch (224) operating handle (166) and then turning the operating handle (166) 90° clockwise and it may be tripped manually by turning the handle 45° in the opposite direction. Automatic tripping is accomplished by one of the automatic devices which lift the trip bar when suitably energized. These devices consist of the shunt trip (500) and the series overcurrent trip (400) and the reverse current trip (600) any or all of which may be supplied with an individual circuit breaker. One or more auxiliary switches (550) and a terminal

block are supplied depending on the number of control and auxiliary circuits to be controlled by the operation of the circuit breaker.

The main power circuit through the circuit breaker consists of the lower stud, series overcurrent trip coil (if supplied), shunt, moving contact assembly, stationary contact, and upper stud, all connected in series in the order named.

Mounting

DBN-40S circuit breakers are supplied in individual enclosures, see Fig. 1.

B-2. ELECTRICALLY OPERATED CIRCUIT BREAKER

The electrically operated circuit breaker is basically the same equipment described in Section B-1 with the exception that it is equipped with a closing magnet (340), a closing relay (300), and a shunt trip coil. These three attachments plus a source of closing power and a control switch enable an operator to close the circuit breaker from a remote point.

It should be noted that the addition of a closing magnet for electrical operation does not in any way change the manual operation features of the circuit breaker.

SECTION C - OPERATION AND MAINTENANCE

C-1. CAUTION

Before working on a circuit breaker, load and control circuits feeding it must be de-energized. The breaker should be in the open position, but it should be noted that all circuit breaker studs are not necessarily dead when circuit breaker is open.

Before putting the circuit breaker in regular operation it should be closed and tripped manually several times to see whether all parts are in proper alignment and move freely. Particular care should be taken to make sure the studs have not been forced out of alignment by the bus work. Lift the trip bar by hand with the circuit breaker open to make sure that it does not bind.

C-2. WIRING DIAGRAMS

Reference Figure 3

Figure 3 shows the typical control wiring for a DBN-40S breaker. For complete details refer to applicable diagram in the Switchboard Instruction Book.

C-3. SHUNT TRIPPING

Shunt trip coils have a nominal voltage of 250 volts and a voltage range of 140 to 355 volts.

C-4. ELECTRIC CLOSING

Closing coils and relay coils have a nominal voltage of 250 volts d-c and a voltage range of 200 to 355 volts.

C-5. MAINTENANCE

The frequency of inspection for maintenance will depend upon local conditions but, in general, a complete inspection for preventive maintenance should be made at least once a year. It is recommended that a special inspection be given any breaker that has opened a heavy short-circuit current.

If excessive heating not caused by overcurrent is observed, look for loose or corroded contacts or connections.

When inspecting the circuit breaker, examine the contact surfaces. Rough or high spots should be removed with a clean file or sandpaper. Do not use emery cloth since the dust from this material is a good conductor of electricity and is sure to cause trouble if allowed to settle on insulating surfaces.

More detailed maintenance instructions are given later on in the sections on the individual attachments.

SECTION D - COMPONENTS AND ATTACHMENTS

D-1. GENERAL ASSEMBLY (MANUALLY OPERATED BREAKER)

The DBN-40S air circuit breaker is provided with two series overcurrent trip devices. Both poles are identical, each being provided with a stationary and moving contact assembly and an arc chute.

D-2. GENERAL ASSEMBLY (ELECTRICALLY OPERATED BREAKER)

The general assembly of the electrically operated breaker is similar to that of the manually operated breaker. The addition of a closing magnet, a closing relay and a shunt trip coil makes the breaker electrically operated. In addition to this, the anti-shock-close device is arranged to act on the moving core of the closing magnet rather than directly on the mechanism as in the case of manually operated breakers.

D-3. ARC CHUTES

Reference Figure 4

Function

The arc chute (135) mounted above and surrounding the contact assembly of each pole, has the function of stretching and cooling the arc drawn by the separating contacts so that it may be quickly extinguished and the circuit opened in the least possible time. The arc chutes are an extremely important part of the circuit breaker and the breaker should never be energized without their being mounted in place.

Description

Each arc chute consists of a number of metal plates (138) and (139) and asbestos plates (140) supported in a laminated case (135) and held in place by a clamping plate (136) and insulating tube spacers (146) and two screws (147) through the insulating spacers to the molded base (100). When the arc is drawn by the separating contacts, it moves up into the chute by magnetic and thermal action where it is quickly de-ionized and extinguished thus opening the circuit.

D-4. CONTACT ASSEMBLY

Reference Figure 4

Function

The contact assembly closes and opens the electric circuit through the circuit breaker. The upper stud (120), the stationary contact (121), the series overcurrent trip device (400) (when supplied) and the lower stud (105) are stationary and are mounted rigidly on the molded base (100). The moving contact assembly is hinged on the molded base by pin (127) and is moved in and out by molded insulating link (116) which is pivoted on cross bar (168) Figure 2.

The moving contact assembly is closed and held in the closed position against the force of the accelerating spring (131) by the insulating link (116). When the force exerted by the insulating link is released by tripping the breaker, the accelerating spring quickly moves

AIR CIRCUIT BREAKER

the moving contact assembly to the open position. When the breaker interrupts high short circuit currents, magnetic forces play a large part in the rapid opening of the contacts.

With the circuit breaker in the closed position, main contact surfaces (109) and (121) are held together and carry the load current. When the circuit breaker is tripped, arcing contact surfaces (119) and (123) snap together an instant before main contact surfaces (109) and (121) separate and then the moving contact assembly moves away, drawing the arc between the arcing contacts. This arrangement minimizes arc damage to main current carrying contacts. When the circuit breaker is closed the arcing contact surfaces touch first and then separate as the main contacts touch and the closing operation is completed.

Description

The stationary contact assembly consists of the main contact extruded integral with the upper stud (120) and the arcing contact (123) fastened to the extruded copper section by two screws (124). Contact surfaces (121) and (123) are special arc-resisting silver alloy inserts.

The moving contact assembly consists of a contact base (110) of copper to which is fastened arcing contact (118) by two bolts (112) which are locked with locking clips (113). Main and arcing contact surfaces (109) and (119) are silver alloy inserts welded to their respective bases. Contact base (110) is riveted and soldered to shunt (108) which is bolted at its lower end either to a connector (133) when a series overcurrent trip device is not supplied, or to an overcurrent tripping device. The shunt (108) is a flexible bundle of thin copper strips that carries current from the moving contact assembly to the lower stud. Contact base (110) is connected to contact link (106) with pin (115) and has a limited freedom of rotation about this pin. Contact link (106) is hinged by pin (127) to bracket (125) fastened to molded base (100) by two screws (128). Pin (130) mounted in bracket (125) has the function of restraining shunt (108) when the circuit breaker is tripped.

The moving contact assembly is attached to the mechanism cross bar (168) Figure 2 by molded insulating link (116) which is screwed on metal link (111) and locked by nut (114). When the breaker is tripped all force is removed from the cross bar and accelerating spring (131) quickly snaps the moving contact assembly from the closed to the open position.

Adjustments

The correct contact pressure of the DBN-40 is about 50 pounds. This pressure is obtained when the arcing contact surfaces are 3/32 inch apart when the breaker is closed. This gap may be adjusted after removing arc chute (135) by removing two screws (147) and cross bar (168). Loosen locknut (114) and turn insulating link counterclockwise if the gap is too small and clockwise if the gap is too large. The lockout should be retightened and the cross bar and arc chutes replaced.

Replacements

To replace moving arcing contact (118):

- (a) Remove arc chute (135) by means of screws (147).
- (b) Bend down locking clips (113) and remove bolts (112). When replacing bolts be sure to relock them by bending up corners of clips.

To replace stationary arcing contact (123):

- (a) Remove arc chute (135) by removing screws (147).
- (b) Removing screws (124) frees the contact.

To replace contact arm accelerating spring (131):

- (a) Remove arc chute (135) by removing screws (147).
- (b) End of spring may be slipped off projection on contact arm and replaced.

D-5. MECHANISM

Reference Figure 5

Function

The operating mechanism opens and closes the circuit breaker contacts by moving the cross bar (168) Figure 2 to which the moving contact assemblies are attached by insulating links. The breaker is closed manually by turning the operating handle quickly and smoothly as far as it will go (90°) in a clockwise direction. The breaker may be tripped manually by turning the handle 45° in a counterclockwise direction.* The breaker is tripped automatically by one of the automatic devices described later which rotate trip lever (220) about pin (224).

The mechanism is "trip free", that is, it is not possible to close the breaker if one of the automatic tripping devices moves the trip bar up during the closing stroke or if the trip bar is held in the raised position.

Description

The operating mechanism consists of a group of toggle links, and a latch attached to the operating mechanism frame on fixed pins (214), (226), (241), (216), and (224). The cross bar (168) is held by the closing lever (207). Rotating the operating handle clockwise moves the mechanism linkage from the open position shown in Figure 5 to the closed position shown. This is accomplished when the roller (236) on the end of the operating handle shaft (232) forces the first toggle link (203) upward pushing second toggle link (204), third toggle link (206) and closing lever (207) ahead of it. The motion of the toggle linkages is directed by link (205) which is pivoted at its lower end on pin (217) in latch (208). Latch (208) in turn is restrained from moving by roller latch (210) which is pivoted on pin (214) and engages trigger (221) on trip lever (220). The linkage is held in the closed position by pawl (209) which latches under pin (227). The handle shaft and lever are returned to the normal position after closing by handle return spring (233).

The mechanism is opened by rotating trip lever (220) counterclockwise. This is accomplished either by rotating handle counterclockwise, in which case the handle shaft lever strikes the extreme left end of trip lever (220) to move it downward; or by forcing push rod "E" of the tripping attachments to strike trip finger screw (243). In either case the counterclockwise rotation of the trip lever (220) moves trigger (221) out of engagement with the lower end of the roller latch (210), which in turn permits the roller latch to rotate counterclockwise out of engagement with latch (208). Latch (208) is then free to rotate in response

* Handle Latch (224) must be held while closing or tripping.

AIR CIRCUIT BREAKER

to the pull of the latch link (205) so that the mechanism assumes the trip free position shown in Figure 5 in which the contacts are open but part of the mechanism levers are in the closed position. In this position pawl (209) is disengaged from pin (227) by a lug on link (204) which pushes it up permitting the linkage to collapse to the open position shown in Figure 4.

Trip spring (234) returns operating handle to the normal vertical position after manual tripping.

Anti-Bounce Latch

The anti-bounce latch (245) prevents the closing lever (207) from bouncing off its stops and re-closing the circuit when the circuit breaker interrupts maximum short circuit currents. When the circuit breaker interrupts these high currents, the top of the closing lever knocks the latch up, causing the latch to engage the closing lever should it tend to return to the closed position. The latch is mounted on top of the mechanism frame.

Position Indicator

Position indicator (230) is formed from sheet metal and is pivoted on pin (241). It is visible from the front of the circuit breaker through a window in the faceplate and mechanism frame. See Figure 2. With the circuit breaker in the open position shown in Figure 5, the yellow face of the indicator shows through the window. The word "OPEN" is stamped on this yellow face. When the breaker closes, pin (218) of the closing lever (207) pulls indicator link (228) to the right, thus rotating the other face of the indicator up into a position visible through the window. This face is painted blue and is stamped with the word "CLOSED".

Replacements

To replace roller latch spring (223):

- (a) Prepare to remove mechanism by removing anti-shock-open device (250), terminal block (169) and auxiliary switch (550) all of Figure 2. Avoid removing any more wires than necessary. It will usually be possible to push the devices aside without removing the wiring. Tag any wires which may have to be removed.
- (b) Rotate handle (166) clockwise until pin (277) is visible through a hole in the right side of the mechanism frame. Using a small rod as a pusher, shove this pin part way through the hole until the rod of the anti-shock-close device, in the case of manually operated circuit breakers, or the operating rod of the closing magnet, in the case of electrically operated circuit breakers, drops off. Return the pin (227) to its proper location and allow linkages to fall open. This frees mechanism from anti-shock-close device or the closing magnet as the case may be.
- (c) Remove handle (166), faceplate (155) and cross bar (168) of Figure 2.
- (d) Remove the four bolts which hold mechanism to the shelf (152) Figure 2. This frees mechanism from shelf but frees also either anti-shock-close device (360) of manually operated breakers or closing magnet (340) of electrically operated breakers.

These devices should be temporarily replaced while repairs are being made to the mechanism.

- (e) Removal of pin (224) enables trip lever (220) to be removed and spring (223) may then be replaced.

To replace pawl springs (215) and (240):

- (a) Repeat (a) to (e) above.
- (b) Remove pin (214) far enough to release pawl (209). Roller latch (210) and hold-in which are pivoted on the same pin will then remain in place. Replace springs (215) and (240), making sure that their ends are supported correctly as indicated in Figure 5.

To replace trip spring (234) or handle return spring (233):

- (a) Repeat operations (a) through (e) under replacement of roller latch spring.
- (b) Remove pin (214) and drop pawl (209) and roller latch (210) out of frame.
- (c) Remove snap ring from handle shaft (232) and push the handle shaft back into frame. Spring (233) or (234) may then be replaced.

To replace retrieve spring (225):

- (a) Repeat operations (a) through (e) under "Replacement of Roller Latch Spring".
- (b) Remove cover (239).
- (c) Remove pins (241) and (226). Retrieve spring (225) may then be replaced.

When replacing mechanism springs, particular attention should be given to the mechanism drawing Figure 5 to see that spring ends are properly placed and that torsion springs are properly oriented to exert torque in the proper direction.

D-6. ANTI-SHOCK-CLOSE DEVICE

Reference Figure 6

Function

This device serves to prevent the circuit breaker contacts from closing from shock when open. This is accomplished by an arrangement whereby a mechanical escapement device or "ticker" is operated by the closing of the breaker. Shock blows tending to close the breaker are of such short duration that the mechanical escapement device does not have time to operate and the device effectively locks the open circuit breaker in the open position under shock conditions.

Description

The anti-shock-close device consists of a ticker case (360) Figure 6 which contains the ticker assembly, bolted to the platform by two bolts (379). A rod and cam pusher assembly (363) is connected at its upper end to pin (227) Fig. 5 of the mechanism. Whenever circuit breaker is closed, rod (363) is pulled up by pin (227) and cam (361) is caused to rotate in a clockwise direction around pin (370) against the torsion of return spring (369). As the cam rotates in this manner, oscillator wheel (362) is caused to rotate clockwise around pin (372) by pin (369) mounted in cam (361). The rotation of wheel (362) is regulated by mechanical oscillator (364) which is pivoted on pin (365). This oscillator oscillates due to the engagement of its teeth with the teeth of oscillator wheel (362). When the circuit breaker

is tripped, rod (363) drops unimpeded and return spring (369) returns cam and consequently oscillator wheel to the "breaker open" position shown in the figure.

Shock blows tending to close the circuit breaker would have to act in such a way as to raise rod (363). These blows are of such short duration that the cam is restrained long enough by the oscillator wheel and oscillator to prevent closing of the circuit breaker.

Replacements

To replace return spring (369):

- (a) Remove handle (166) and faceplate (155) Figure 2.
- (b) Remove guide pieces (374) and (375) by removing bolt (376).
- (c) Remove bolts (379) and remove case (360) from shelf.
- (d) Removing snap rings (367), (371) and (373) will allow corresponding pins to be removed. The various parts are then free to be removed and the spring may be replaced.
- (e) After reassembly, be sure that the cam operates freely and that it returns freely to its starting position when pushed over.

D-7. CLOSING MAGNET (ELECTRICALLY OPERATED BREAKER)

Reference Figure 7

Function

The closing magnet is the device used to close the circuit breaker electrically and is mounted directly below the mechanism and under the shelf of the circuit breaker. It is secured to the shelf with the same four bolts that hold the mechanism in place.

Together with a control switch, a source of power, and the closing relay, the closing magnet enables an operator to close the circuit breaker from a remote point.

Description

The closing magnet Figure 7 consists of an iron frame or yoke which is securely bolted to the circuit breaker shelf, a plunger or moving core (348), an operating rod (346), a stationary core (355), and a coil (350).

The operating rod (346) connects the moving core (348) to pin (227) Figure 5 of the mechanism. It will be observed that an upward movement of this pin will cause the mechanism to close and latch the circuit breaker.

When coil (350) is energized by contact of relay (see Figure 3) the moving core (348) moves upward in response to the magnetic attraction between stationary and moving cores across air gap "A". About one-tenth of a second is required for the solenoid to close and latch the circuit breaker. When the moving core moves into the "breaker closed" or "closed gap" position, trip bracket (353) trips the relay mechanically, and its contacts open, thus de-energizing the closing magnet. The closing coil is momentarily rated and serious damage will result if potential is allowed to remain on its terminals through improper adjustment of trip

stud (327) of the relay Figure 8 so that the relay does not trip and interrupt close coil circuits. When the moving core and operating arm have pushed the mechanism linkages to the closed and latched position, pin (227) holds the moving core in the "closed gap position".

When the mechanism is tripped pin (227) falls allowing operating arm and moving core to fall with it.

Replacements

To replace closing coil (350):

- (a) Remove handle (166) and faceplate (155) Figure 2.
- (b) Remove trip bracket (353) and cam pusher by removing bolts (352).
- (c) Remove anti-shock-close device from side of closing magnet by removing bolt (354) and bolts (345). This frees punchings (344).
- (d) Disconnect closing coil leads from terminal of terminal block and terminal of closing relay.
- (e) Coil may then be worked out of yoke and replaced.

Anti-Shock-Close Device

On electrically operated circuit breakers, the anti-shock-close device (354) is bolted to the side of the closing magnet. Arm (374) bolted to the bottom of moving core (348) operates cam (361) of the device. Otherwise the operation is identical with that described in Section D-6.

D-8. CLOSING COIL CONTACTOR (ELECTRICALLY OPERATED BREAKER)

Reference Figure 8

Function

The closing relay is used on electrically operated circuit breakers only and is mounted on the underside of the breaker shelf to the left of the closing magnet. The relay has the function of closing and opening the closing coil circuit in electrical operation. Together with the shunt trip, the relay enables the operator to control the circuit breaker electrically from a remote point by means of control switches. The operating coil of the DBN-40S closing relay has a momentary rating.

Detailed Description

The relay base (300) is molded from insulating material. Contact assemblies, coil assembly, and other parts are attached to the base. Frame (305) serves as part of the magnetic circuit of coil (338) and also serves to hold the coil in place. This frame or yoke is fastened to the molded base by three screws (318). The coil (338) is wound on a molded spool (339) and is held in place by guide tube (337) which extends from the top of the molded base through the bottom of the frame (305) and through the center of the spool.

AIR CIRCUIT BREAKER

The moving core (333) is free to slide up and down in the guide tube (337). In moving up in response to the magnetic pull from the stationary core when the coil is energized by closing switch CSC, Figure 3, the moving core pulls up latch (336) which is fastened with pin (335). When the coil (338) is energized, spring (334) bearing against latch (336) holds latch in such a position that it is hooked under latch pin (316) thus causing moving contact arm assembly (301) to rotate counterclockwise around contact arm pin (329), thereby compressing spring (314). The moving contact (303) is thus pulled against the stationary contact (304) completing the circuit. In Figure 8 the moving core is shown in the upper or "contacts closed" position.

As soon as the contacts close, current starts flowing through the closing coil of the circuit breaker. The moving core (348) of the closing magnet, Figure 7, moves up, closing the circuit breaker. Trip bracket (353) fastened to moving core moves up with it and strikes trip stud (327) of the relay. The trip screw is fastened to release bracket (308) which is caused to rotate counterclockwise around pin (317) against the torque exerted by torsion spring (313). When release bracket (308) is rotated in this manner, it strikes the bottom of latch (336) rotating it counterclockwise around pin (336) against the force of spring (334). This rotation of latch (336) causes it to become disengaged from latch pin (316) and consequently spring (314) extends causing moving contact assembly (301) to rotate clockwise thereby snapping moving contacts (303) away from stationary contacts (304) and interrupting the closing coil circuit. With the control switch still energizing the closing coil relay, the length of time the coil is energized is determined by the operator at the remote control station.

The moving contact (303) is resiliently mounted by means of spring (312) around stud set into the moving contact arm (301) and is secured by elastic stop nut (315). This causes a slight rolling and wiping action on the spherically shaped contact surfaces as they meet which helps to insure a positive electrical connection.

An arc chamber (310) molded from arc resisting material surrounds the left hand contacts. It is held in place by means of the two iron plates of the blowout magnet assembly (310) which in turn is fastened to the molded base (300) by means of screw (323). The blowout magnet coil is connected in series with the contacts and consequently flux is flowing through the magnetic circuit and the air gap of the blowout magnet assembly at the time the contacts part and draw an arc. The magnetic circuit is so arranged that its air gap is across the arc chamber and the arc. The arc is forced by magnetic action down into the arc chamber where it goes out due to the stretching and cooling process. The right hand contact is not used.

Adjustment

The relay trip out sequence should be checked as follows:

- (a) Remove cover (309) from relay and disconnect closing coil lead from relay.
- (b) Energize relay coil (momentary rated coil may be safely energized for 3 or 4 minutes). Close breaker slowly manually and observe relative position of cross bar (168) Figure 2 when trip bracket (353) Figure 7 releases relay contacts. The release position should occur just before the breaker latches closed; but within the last 1/64 inch travel of the cross bar. Bend trip bracket (353) if required to obtain above adjustment. With breaker closed, relay coil should be de-energized and energized several times to make sure relay contacts will not close.
- (c) Reconnect close coil and close breaker electrically. With breaker closed, relay coil should be de-energized and energized several times to make sure the relay contacts will make.

Replacement of Spare Parts

DANGER!

Before working on the relay, make sure that the circuit breaker is open and that the upper and lower studs are dead. Make sure that control circuits are dead. Realize that control wiring may be "hot" even though the main circuit breaker studs are dead.

Before replacing parts of the relay, it is best to disconnect the wiring and remove it from the circuit breaker:

- (a) Remove screw (322) and lift off molded cover (309) of the relay thus exposing the terminals.
- (b) Remove and tag the wires from the terminals by loosening screws (320).
- (c) One or more leads from the relay coil may be connected to the terminal block. Remove front cover of the terminal block and disconnect leads.
- (d) Remove the two screws through the circuit breaker shelf (152) Figure 2 which hold the relay to the shelf.

The relay is now free from the circuit breaker.

To replace relay coil:

- (a) Remove three screws holding coil frame (305) to molded base (300) and remove from base.
- (b) Pull out guide tube (337) allowing stationary core to drop out. Coil is now free to be replaced.

To replace latch spring (334):

- (a) Remove frame (305) as before.
- (b) Lift out moving core assembly (333).
- (c) Rotate latch clockwise as far as it will go.

Spring will drop out. Replace.

To replace trip spring (313):

- (a) Remove release bracket pin (317).
- (b) Replace pin and new spring.

To replace moving contact arm assembly spring (314):

- (a) Remove contact arm pin.
- (b) This releases moving contact arm assembly (303) and spring (314) may then be replaced.

To replace moving contact (303) or contact spring (312):

- (a) Remove elastic stop nut (315) and replace spring (if necessary).

AIR CIRCUIT BREAKER

- (b) If the moving contact is to be replaced, disconnect its lead from under the terminal screw (319) and remove and replace.

To replace blowout magnet assembly:

- (a) Remove leads of blowout coil.
- (b) Remove screw (323) and replace blowout magnet assembly.

To replace stationary contact assembly:

- (a) Remove blowout magnet assembly as outlined above.
- (b) Remove the screw (321) and replace contact.

D9. ANTI-SHOCK-OPEN DEVICE

Reference Figure 9

Function

This device prevents tripping of the circuit breaker due to rotation of the trip lever caused by shock but allows normal rotation of the trip lever by tripping devices.

Description

The bracket (250) is mounted on the supporting frame shelf to the immediate right of the operating mechanism frame (200) Figure 1 and is held to the shelf by two bolts (256). Lever (252) is pivoted on pin (253) as is plate (254). Lever and plate are connected by bolt and elastic stop nut (265) in such a way that if the trip bar raises, lever (252) rotates counter-clockwise around pin (253) and plate (254) is caused to rotate in the same direction. Conversely, if plate (254) is restrained from rotating, trip bar is held down by lever (252). Under shock conditions, plate (254) is restrained from moving in the following manner:

Studs (255) and (258) are suspended on pin (251) and plate (254) is fitted with a slot in its end arranged so that the plate will slide down and allow the circuit breaker to trip under normal tripping impulses. Under shock conditions, however, the two outboard studs are caused to rotate around pin (251) due to the off center weights (257), thus jamming the plate (254) from sliding down. The middle stud is actuated by a separately pivoted weight (267) which rotates about pin (264). Spring (262) serves to hold weight in position shown during normal operation.

Replacements

To replace plate spring (263):

- (a) Remove cover by removing screws (266).
- (b) Remove device from shelf by removing two screws (256).
- (c) Remove right hand snap ring from pin (253) and withdraw pin (253) far enough to free spring (263).

Adjustment

With the breaker closed any motion of trip bar (157) should cause plate (254) to move down. Pushing trip bar down about 1/16 inch should cause 1/32 inch or less upward motion of slotted end of plate (254). Adjustment should be made with breaker open by turning nut (265).

D-10. SERIES OVERCURRENT TRIP DEVICE

Reference Figure 10A

Function

This device provides for selective protection of the various portions of the electrical system under two distinct conditions of current: First, for low overcurrent values, it will trip the breaker after a SHORT TIME DELAY; and second for still higher values of overcurrent it will trip the circuit breaker instantaneously. See Figures 10B and 10C for overcurrent tripping characteristic curves for S.O. 32-Y-2226 and 32-Y-2227 respectively (150 KW motor generator and DC backup breakers).

Description

The device is actuated by an electromagnet connected in series with the moving contact assembly and the lower stud of the circuit breaker.

The SHORT TIME DELAY pickup calibration is set at the factory at the ampere setting marked on the nameplate. The operating time consists of three different time settings: minimum, intermediate and maximum time. If an overcurrent occurs of greater magnitude than the short time delay pickup setting, the circuit breaker will trip subject to a short time delay as determined by a gear escapement mechanism.

At currents above the instantaneous setting, the circuit breaker trips without any intentional time delay. The pickup setting is made at the factory at some ampere value from 5 to 30 times the series overcurrent trip coil rating and is not readily adjustable in the field. The maximum setting shall not exceed 18,000 amperes.

If during the short time delay period the current drops to 100% of rated overcurrent trip coil current, the series overcurrent trip device will reset and the breaker will not trip provided the overcurrent has not persisted beyond the time indicated by the lower edge of the band curve for the particular breaker involved.

Short Time Delay

The tube (423) consists of an upper non-magnetic tube and a lower core (424) of magnetic material.

With an overcurrent in excess of pickup, the magnetic force between lower core (424), and yoke ring (475) will cause the tube to rise and trip the breaker restrained only by the mechanical escapement device.

The pin (472) in lower core is attached to a mechanical escapement device enclosed in housing (458). This device consists of a lever (459) pivoted on a fixed pin (463) and connected through instantaneous spring (420) to gear segment (460) which operates pinion (474) and oscillator wheel (461) which is on the same shaft. Oscillator wheel (461) is impeded from free rotation by oscillator (462).

Instantaneous Trip

With fault currents of sufficient magnitude to extend instantaneous spring (420), the operation is identical with the above except that the upward motion of the tube is not restrained by oscillator (462) due to the extension of instantaneous spring (420).

Replacements

To replace calibration springs (410):

- (a) Remove two bolts (451) and (478) from back of panel and remove trip device.
- (b) Remove insulation cover (484) by removing screws (495). Calibration springs (410) are now accessible for replacement.

To replace instantaneous spring (420):

- (a) Repeat (a) and (b) above.
- (b) Remove housing (458) from yoke (457) by removing four screws (476).
- (c) Spring (420) may be replaced by loosening adjusting screw (469). Arm (456) must be pin pricked near the screw after replacement for locking purposes.

D-11. AUXILIARY SWITCH

Reference Figure 11

Function

The auxiliary switch is used to close or open auxiliary or control circuits. The closed or open positions of its sets of contacts are coordinated with the closed or open position of the main circuit breaker contacts.

Description

The four pole type RC auxiliary switch is mounted on the top of the supporting frame shelf to the left of the operating mechanism. It is operated by shaft (555) and arm (557) which connects to the breaker lever of the operating mechanism. An eight pole auxiliary switch consists of two four pole switches, one mounted above the other.

The contacts are designed to carry 15 amperes continuously or 250 amperes for three seconds.

The auxiliary switch is a shaft-operated, four pole, rotary type having "a" and "b" contacts. An "a" contact is one that is open when the circuit breaker is open, and a "b" contact is one that is closed when the circuit breaker is open.

A square shaft (555) extends through the rotor molds (560) which in turn insulate and support the rotor contacts (562). The rotor assembly is clamped together into a solid unit by screw (564). The rotor contacts are set 60° apart for 60° rotation of shaft (555).

Contact fingers (553) have one end hooked into stem (551) with spring (554) maintaining pressure between the finger contact and stem. The center of the contact finger bears against a stop surface in casing (550) to position the outer end of the contact finger.

Replacement of Auxiliary Switch

- (a) Remove and tag the terminal connections.
- (b) Disconnect arm (557) from closing lever, remove the two mounting bolts and remove switch.
- (c) Remove link from closing lever and add new switch.

D-12. SHUNT TRIP DEVICE

Reference Figure 12

Function

The shunt trip device serves as a means of tripping the circuit breaker from some remote point by the closing of a control switch or relay contacts at that remote point.

Description

The shunt trip device is mounted on the extreme right end of the supporting frame shelf. It consists of a frame, coil and moving core mounted horizontally. Energizing trip coil (513) causes a magnetic attraction between stationary core (503) and moving core (504) which causes moving core (504) to move to the left rotating trip lever (501) about pin (502). Lever (501) raises trip bar (157) Fig. 1 to trip the circuit breaker. The opening of the circuit breaker de-energizes the shunt trip coil through an "a" contact of the auxiliary switch. See Section D-11. Spring (508) returns moving core (504) to its normal position. Non-magnetic washer (510) prevents residual magnetism from holding the cores together when the coil is de-energize

Replacements

To replace coil (513):

- (a) Disconnect the shunt trip leads from the auxiliary switch and cut-off switch.
- (b) Take out the two bolts (515) and remove the shunt trip assembly from the supporting frame
- (c) Remove pin (502) and screws (509) holding plate (505) in place and drop out the moving core (504), stationary core (503) and sleeve (507). The coil is then free to be replaced.

To replace spring (508):

- (a) Repeat operations (a) and (b) above.
- (b) Remove pin (502) and replace spring (508).

D-13. REPAIR PARTS

Potential coils, springs, arcing contacts, and auxiliary switches are supplied as repair parts. Refer to consolidated repair parts list for further details.

AIR CIRCUIT BREAKER

REPAIR PARTS LIST
 NAVY CONTRACT - NOBS- O32-Y-2227
 WESTINGHOUSE G.O. NH-51123-Y S.O.*32-Y-2226

ITEM NO.	NUMBER OF REPAIR PARTS	NO. INSTALLED PER VESSEL	NAME OF PART	IDENTIFICATION			
				WESTINGHOUSE			STANDARD
				STYLE NO.	WT. LB.	DRAWING NO.	NAVY STOCK NO.
○ *	1	6	Contact-Moving Arcing	1574789	.15	18-A-9894	H17C77994-8188
○ *	2	6	Contact-Stationary Arcing	1766536	.22	21-A-3958	P17WX-3350
○ *	3	2	Spring-Acceleration	1491496	.03	9-D-9360	H17WX-13159
○ *	4	1	Spring-Pawl	1718591	.04	26-D-2190	
○ *	5	1	Spring-Roller Latch	1584498	.01	21-D-7688	H17WX-13165
○ *	6	1	Spring-Retrieve (Mech)	1491448	.02	13-D-6568	H17WX-13158
○ *	7	1	Spring-Handle Return	1491497	.05	13-D-3193	H17WX-13160
○ *	8	1	Spring-Trip (Mech)	1491444	.05	13-D-3193	H17WX-13157
○ *	9	1	Spring-Weight (A. S. Open)	1404668	.02	9-D-9236	H17WX-13156
○ *	10	1	Spring-Reset (A. S. Open)	1574793	.02	18-D-6418	H17WX-13164
○ *	11	1	Spring-Reset (A. S. Closed)	1574792	.04	15-D-2198	H17WX-13163
*	12	2	Coil-Shunt Trip 250 V. D. C.	1581779	.6	L-484464	P17WX-1984
*	13	2	Coil-Relay 250 V. D. C.	1581778	.66	L-484463	P17WX-1986
*	14	2	Coil-Solenoid 250 V. D. C.	1581777	3	L-484462	
*	15	2	Auxiliary Switch	1645287	.9	25-B-3146	
*	16	2	Blowout Coil-Relay	1589340	.05	13-C-9668	H17WX-12882
*	17	3	Contact-Relay-L.H. Stat.	1589493	.03	23-A-3609	H17WX-12885
*	18	3	Contact-Relay-Moving	1589495	.03	23-A-3609	H17WX-12886
*	19	1	Spring-Relay-Cont. Arm	1574332	.02	17-D-5806	H17WX-12859
*	20	1	Spring-Relay-Latch	1491484	.02	17-D-5806	H17WX-12856
*	21	1	Spring-Relay-Trip	1533822	.02	18-D-9176	H17WX-12857
*	22	1	Spring-Relay-Contact	1491306	.01	17-D-5806	H17WX-12855
*	23	1	Spring-Shunt Trip-Reset	1491282	.02	17-D-1520	H17WX-12854
○ *	24	1	Spring-Anti-Bounce	1718000	.01	18-D-9178	
○ *	25	1	Spring-Handle Latch	1589485	.02	21-D-7417	H17WX-12883
○ *	26	2	Auxiliary Switch	1397643	.9	18-A-3835	H17WX-11427
○ *	27	3	Spring-Calibration O. C.	1574796	.02	19-D-8833	H17WX-12865
*	28	2	Spring-Inst. (O. C.)	1611891	.02	19-D-8833	H17WX-13173
○	29	1	Spring-Inst. (O. C.)	1611892	.02	19-D-8833	H17WX-13241

DWG. 29-B-6883

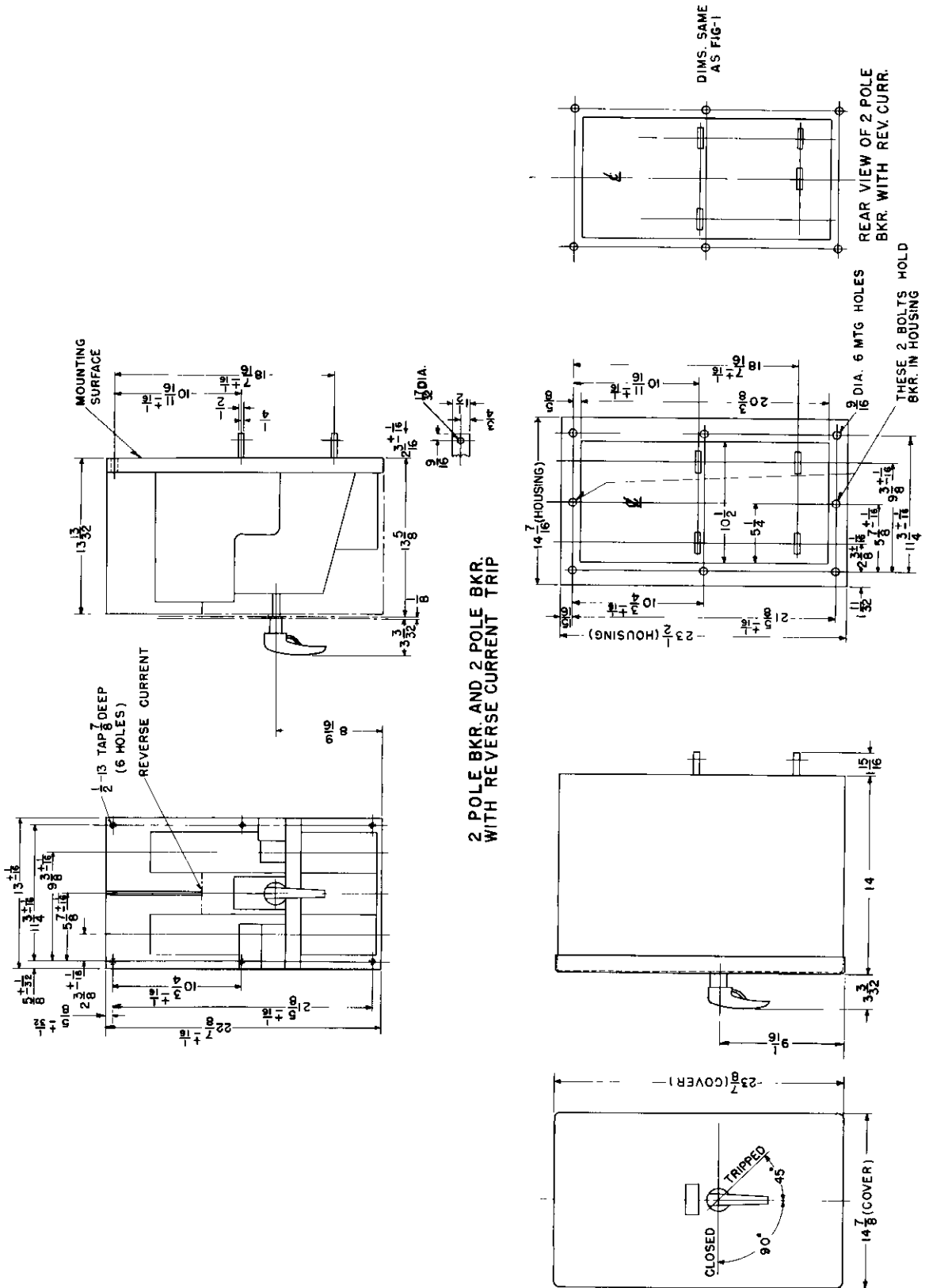
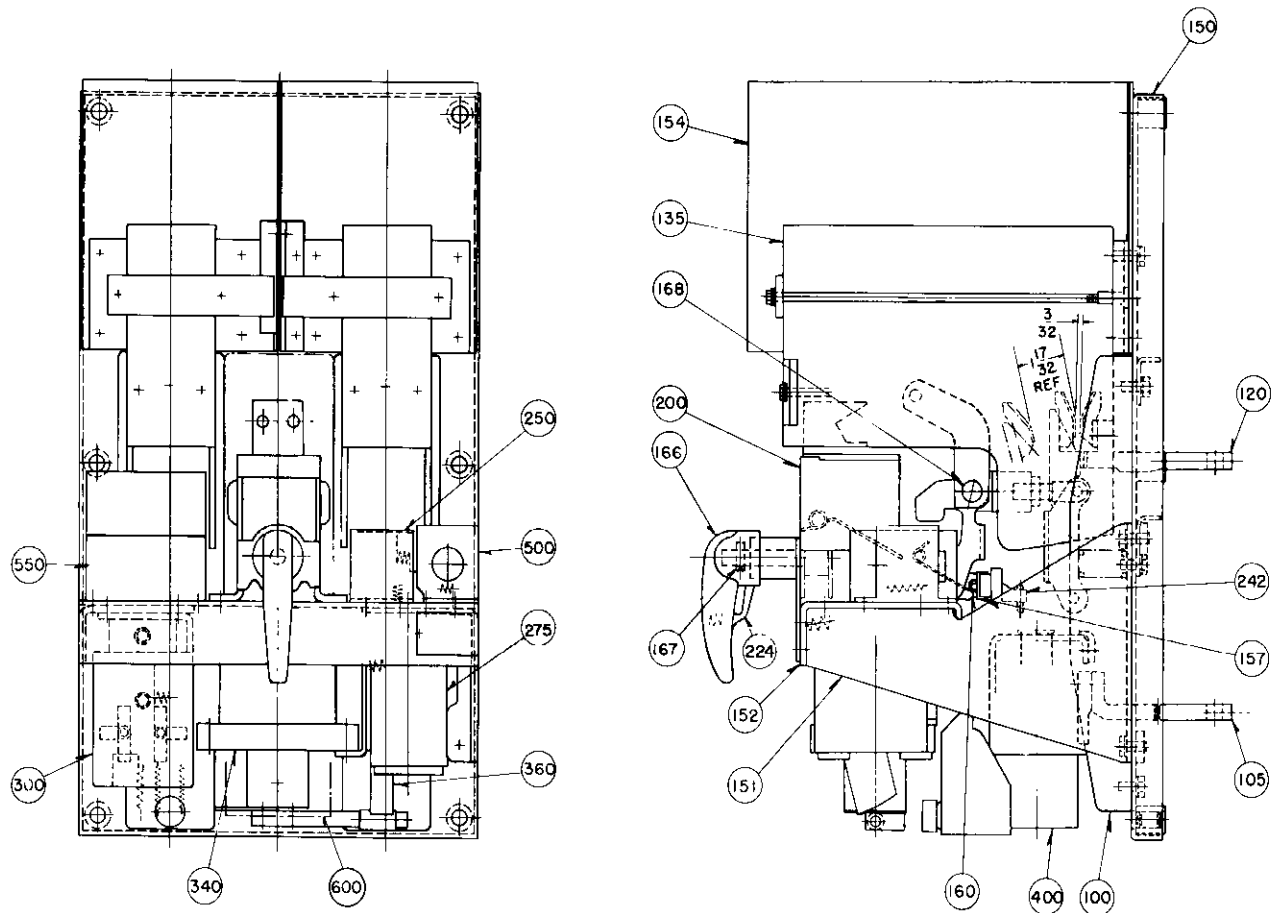


FIG. 1

FIG. 1 - Outline Dimensions



GENERAL ASSEMBLY

100	MOLDED BASE
105	LOWER STUD
120	UPPER STUD
135	ARC CHUTE
150	STEEL PANEL
151	BRACKET
152	SHELF
154	BARRIER
157	TRIP BAR
160	ELASTIC STOP NUT
166	OPERATING HANDLE
167	5/16-24 SET SCREW
168	CROSS BAR
200	MECHANISM
242	TRIP FINGER
250	ANTI-SHOCK-OPEN DEVICE
275	ELECTRIC LOCKOUT
224	LATCH-HANDLE
300	CLOSING RELAY
340	CLOSING MAGNET
360	ANTI-SHOCK-CLOSE DEVICE
400	OVERCURRENT TRIP
500	SHUNT TRIP DEVICE
550	AUXILIARY SWITCH
600	REVERSE CURRENT TRIP

FIG. 2 - General Assembly

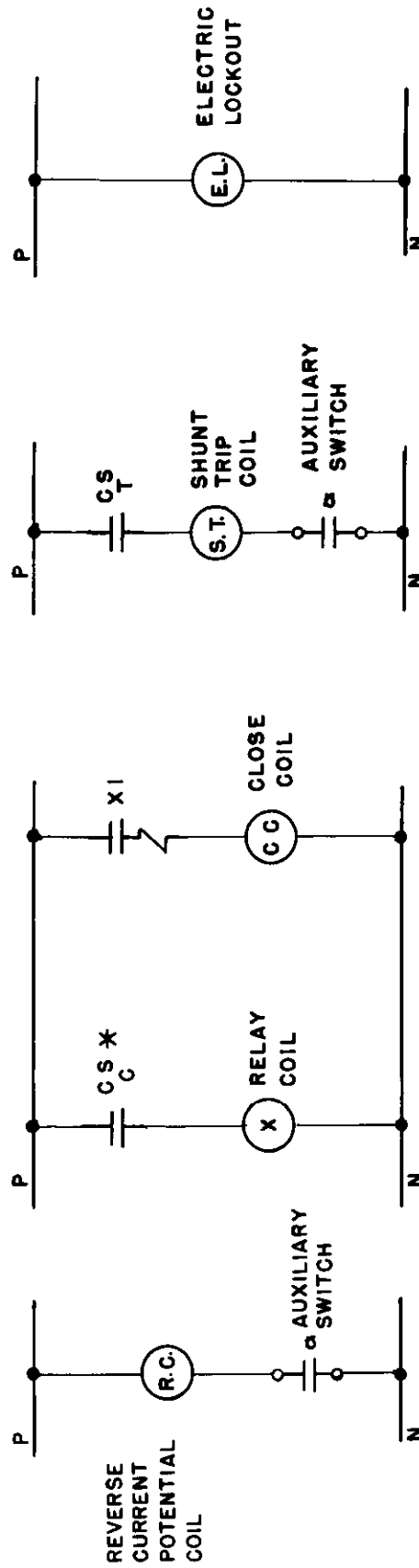
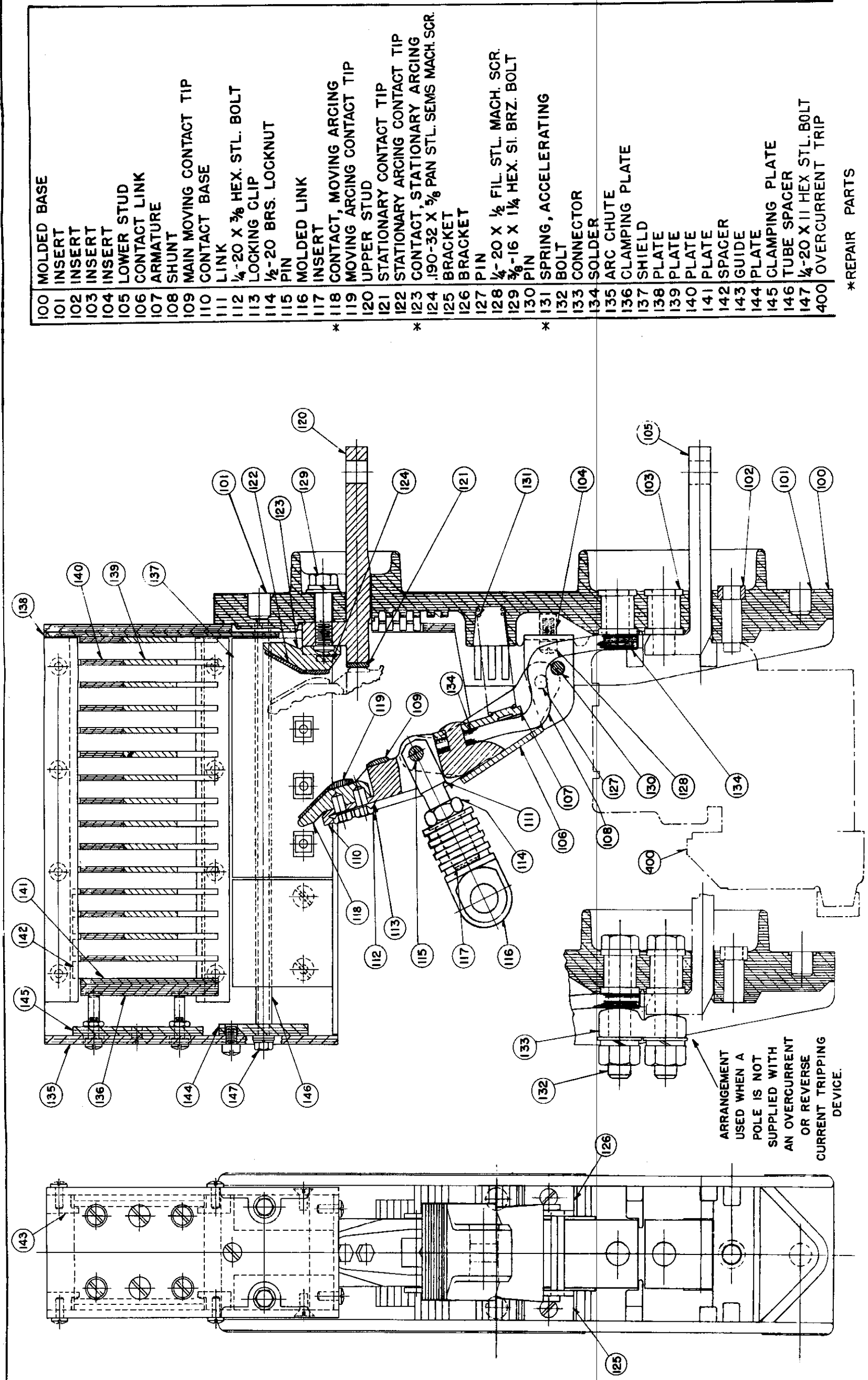
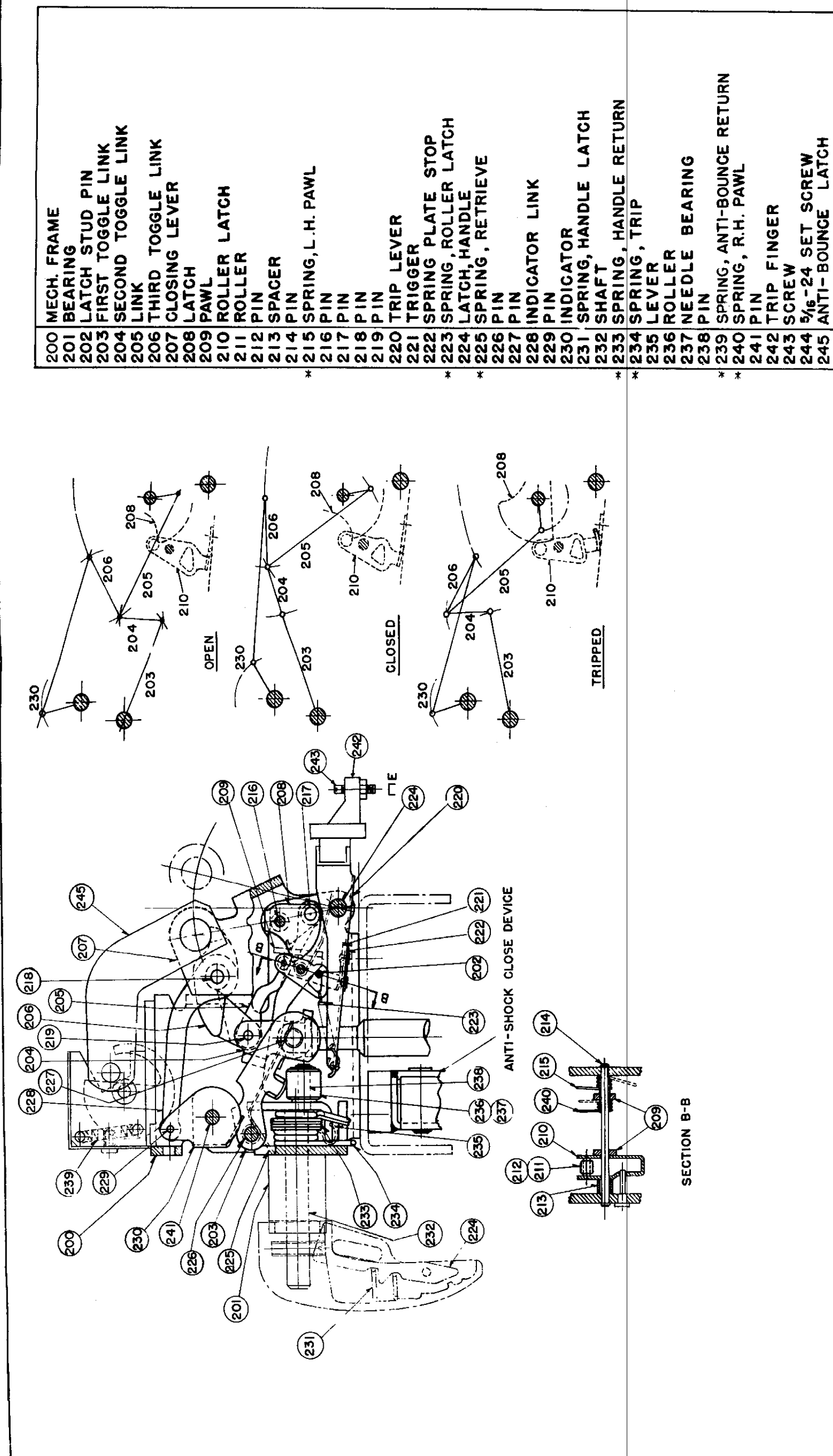


FIG. 3 - Wiring Diagrams.



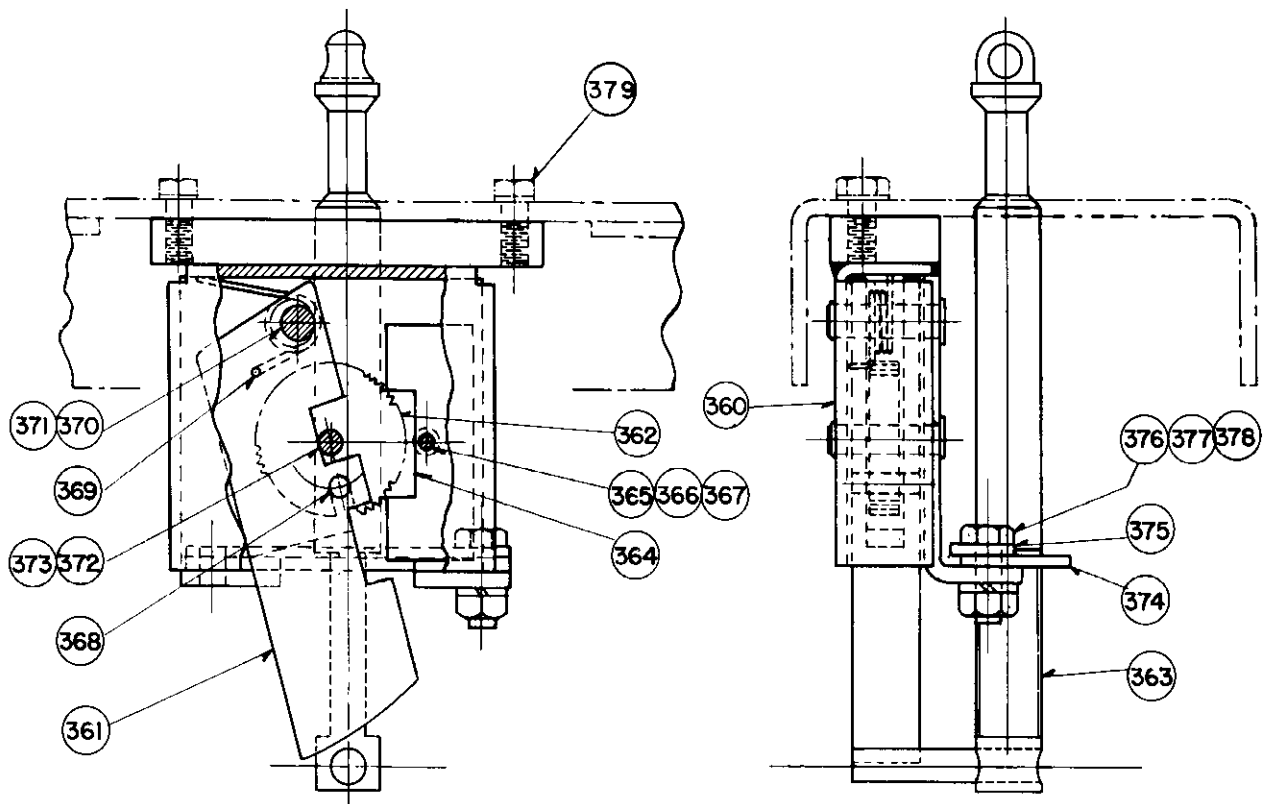
- 100 MOLDED BASE
- 101 INSERT
- 102 INSERT
- 103 INSERT
- 104 INSERT
- 105 LOWER STUD
- 106 CONTACT LINK
- 107 ARMATURE
- 108 SHUNT
- 109 MAIN MOVING CONTACT TIP
- 110 CONTACT BASE
- 111 LINK
- 112 1/4-20 X 3/8 HEX. STL. BOLT
- 113 LOCKING CLIP
- 114 1/2-20 BRS. LOCKNUT
- 115 PIN
- 116 MOLDED LINK
- 117 INSERT
- 118 CONTACT, MOVING ARCING
- 119 MOVING ARCING CONTACT TIP
- 120 UPPER STUD
- 121 STATIONARY CONTACT TIP
- 122 STATIONARY ARCING CONTACT TIP
- 123 CONTACT, STATIONARY ARCING
- 124 .190-32 X 3/8 PAN STL. SEMS MACH. SCR.
- 125 BRACKET
- 126 BRACKET
- 127 PIN
- 128 1/4-20 X 1/2 FIL. STL. MACH. SCR.
- 129 3/8-16 X 1 1/4 HEX. SI. BRZ. BOLT
- 130 PIN
- 131 SPRING, ACCELERATING
- 132 BOLT
- 133 CONNECTOR
- 134 SOLDER
- 135 ARC CHUTE
- 136 CLAMPING PLATE
- 137 SHIELD
- 138 PLATE
- 139 PLATE
- 140 PLATE
- 141 PLATE
- 142 SPACER
- 143 GUIDE
- 144 PLATE
- 145 CLAMPING PLATE
- 146 TUBE SPACER
- 147 1/4-20 X 1 1/2 HEX STL. BOLT
- 400 OVERCURRENT TRIP

*REPAIR PARTS



- | | |
|-------|----------------------------|
| 200 | MECH. FRAME |
| 201 | BEARING |
| 202 | LATCH STUD PIN |
| 203 | FIRST TOGGLE LINK |
| 204 | SECOND TOGGLE LINK |
| 205 | LINK |
| 206 | THIRD TOGGLE LINK |
| 207 | CLOSING LEVER |
| 208 | LATCH |
| 209 | PAWL |
| 210 | ROLLER LATCH |
| 211 | ROLLER |
| 212 | PIN |
| 213 | SPACER |
| 214 | PIN |
| * 215 | SPRING, L.H. PAWL |
| 216 | PIN |
| 217 | PIN |
| 218 | PIN |
| 219 | PIN |
| 220 | TRIP LEVER |
| 221 | TRIGGER |
| 222 | SPRING PLATE STOP |
| * 223 | SPRING, ROLLER LATCH |
| * 224 | LATCH, HANDLE |
| * 225 | SPRING, RETRIEVE |
| 226 | PIN |
| 227 | PIN |
| 228 | INDICATOR LINK |
| 229 | PIN |
| 230 | INDICATOR |
| 231 | SPRING, HANDLE LATCH |
| 232 | SHAFT |
| * 233 | SPRING, HANDLE RETURN |
| * 234 | SPRING, TRIP |
| 235 | LEVER |
| 236 | ROLLER |
| 237 | NEEDLE BEARING |
| 238 | PIN |
| * 239 | SPRING, ANTI-BOUNCE RETURN |
| * 240 | SPRING, R.H. PAWL |
| 241 | PIN |
| 242 | TRIP FINGER |
| 243 | SCREW |
| 244 | 5/16-24 SET SCREW |
| 245 | ANTI-BOUNCE LATCH |

* REPAIR PARTS

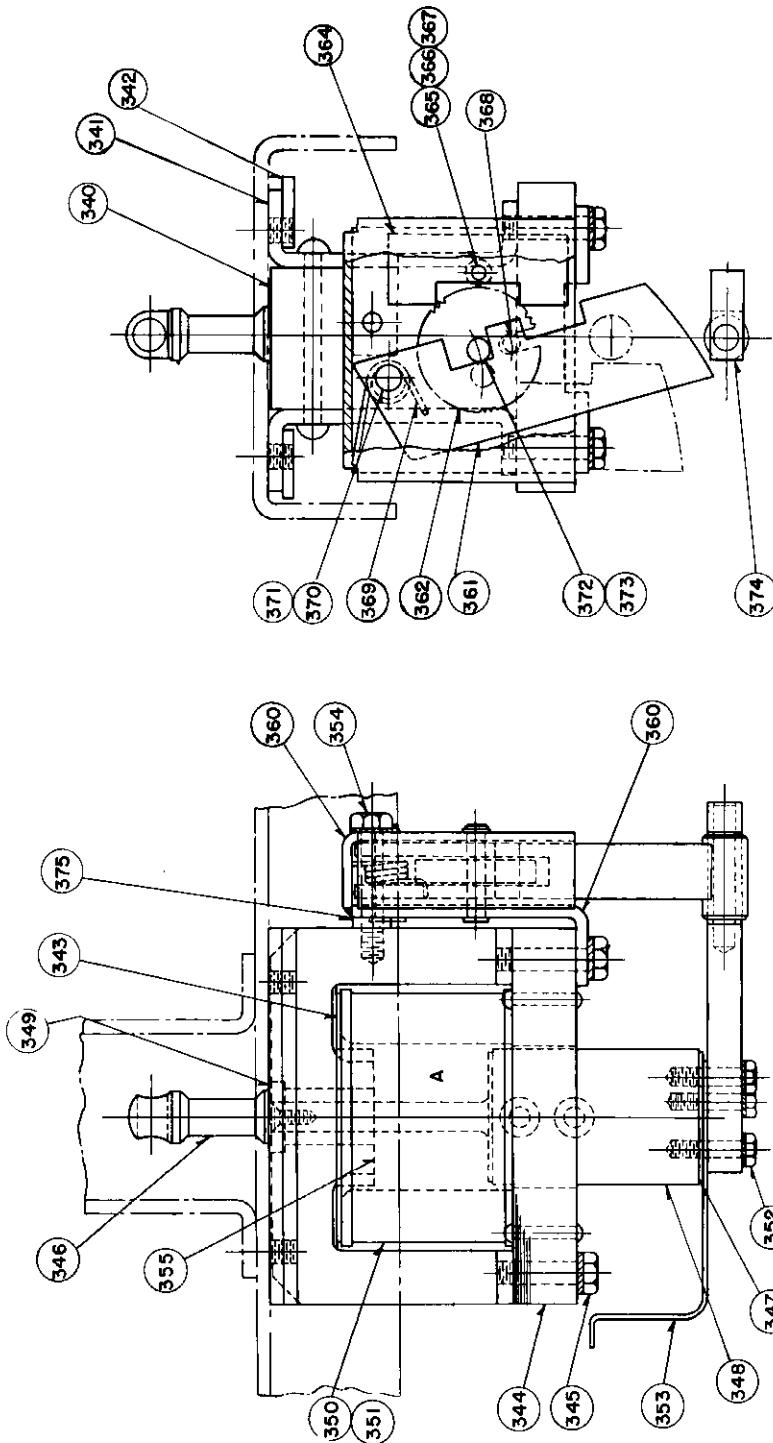


360	CASE
361	CAM
362	WHEEL
363	ROD AND CAM PUSHER
364	OSCILLATOR
365	PIN
366	.190 STD. BRS. WASHER
367	SNAP RING
368	PIN
* 369	SPRING, RESET

*REPAIR PARTS

370	PIN
371	SNAP RING
372	PIN
373	SNAP RING
374	GUIDE
375	GUIDE
376	5/16"-18 X 7/8 HEX. STL. BOLT
377	5/16"-18 HEX. MACH. SCR. NUT
378	5/16 STL. LOCKWASHER
379	BOLT

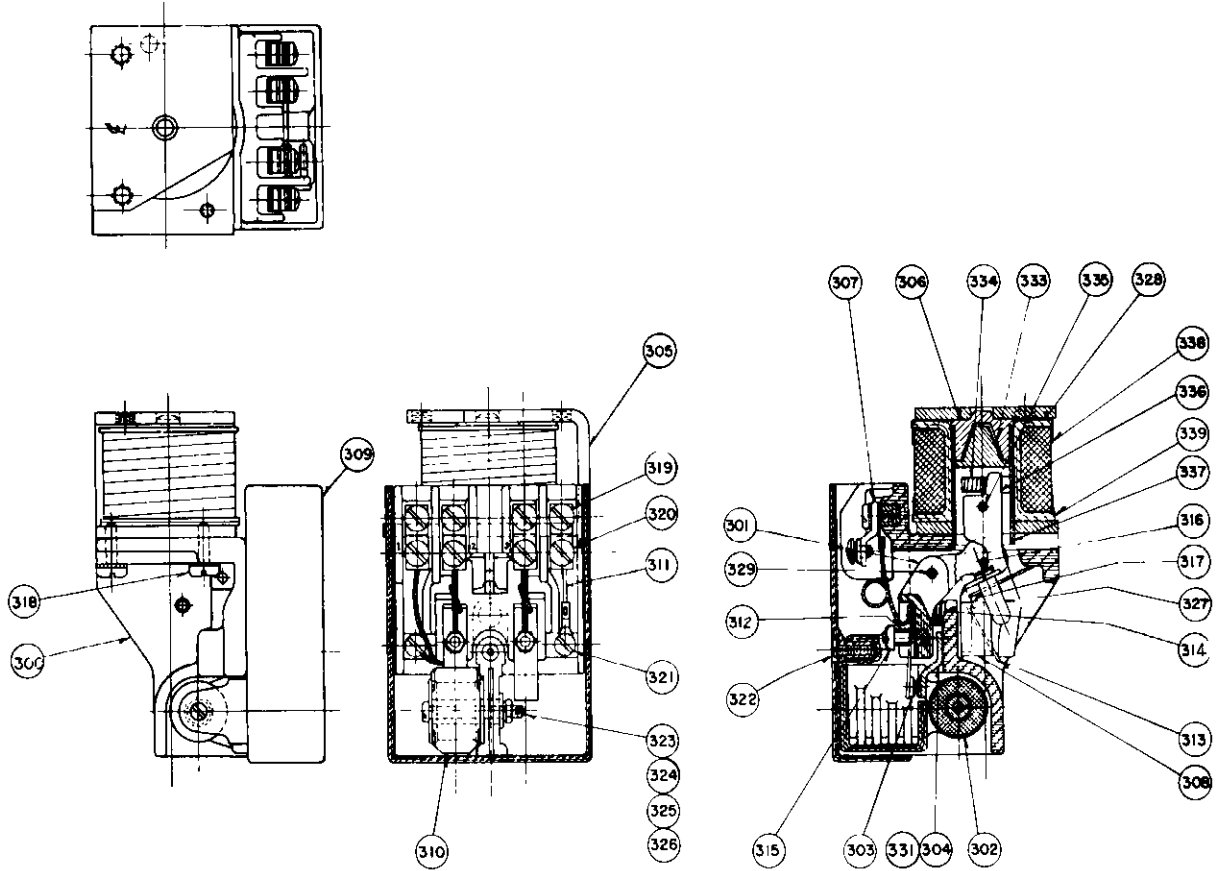
FIG. 6 - Anti-Shock-Close Device



ANTI-SHOCK-CLOSE DEVICE	
360	ANTI-SHOCK-CLOSE DEVICE
361	CAM
362	WHEEL
364	OSCILLATOR
365	PIN
366	.190 STD. BRS. WASHER
367	SNAP RING
368	PIN
* 369	SPRING
370	PIN
371	SNAP RING
372	PIN
373	SNAP RING
374	ARM
375	PAD

CLOSING MAGNET	
340	CLOSING MAGNET
341	SIDE PLATE
342	PAD
343	PACKING WASHER
344	PUNCHINGS
345	BOLT
346	ROD
347	PUNCHINGS
348	MOVING CORE
349	STOP
* 350	COIL
351	SPOOL
352	BOLT
353	TRIP BRACKET
354	BOLT
355	STATIONARY CORE

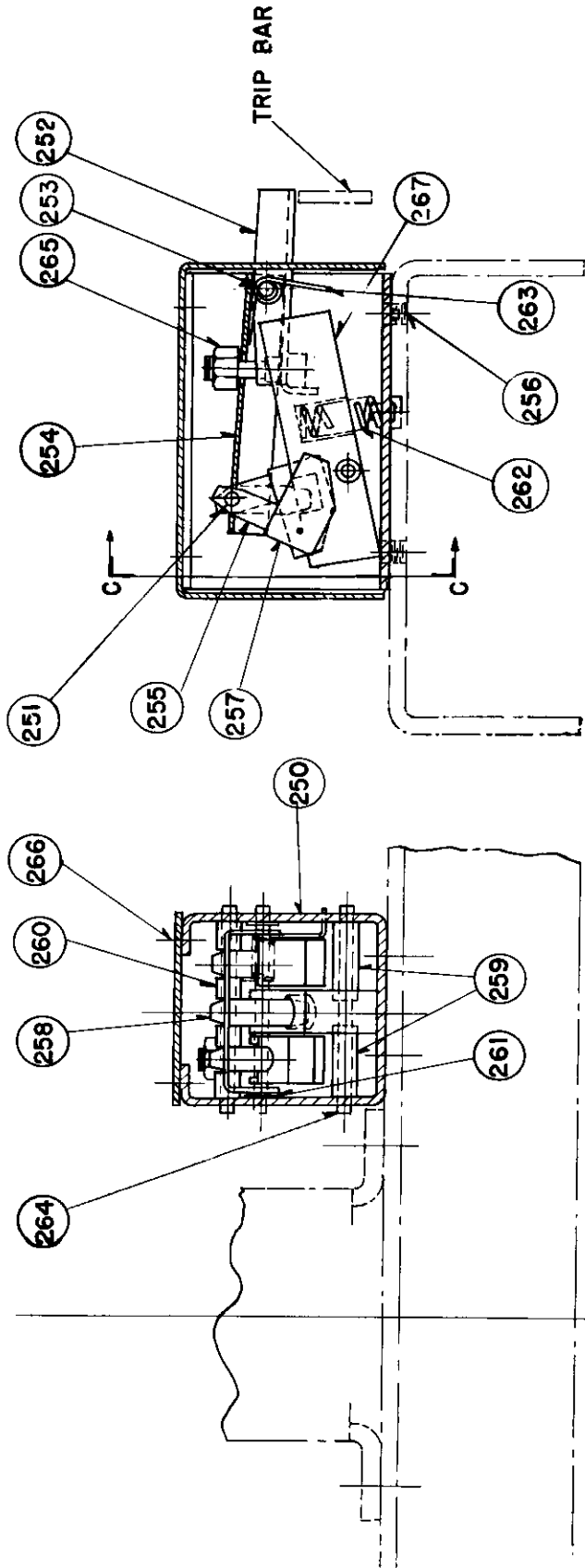
FIG. 7 - Closing Magnet



CLOSING RELAY

300	RELAY BASE	321	164-32X ³ / ₈ PAN HD SCR.
301	MOVING CONT. ARM ASSY.	322	164-32X ³ / ₈ PAN HD. SCR.
* 302	BLOWOUT MAGNET ASSY.	323	190-32X1 ¹ / ₈ PAN HD. SCR.
* 303	MOVING CONT. ASS Y.	324	190 STD. WASHER
* 304	STAT. CONT. ASS Y. R.H.	325	190 STD. LOCKWASHER
305	FRAME	326	190-32 NUT
306	STAT. CORE	327	TRIP STUD
307	TERMINAL BRACKET	328	SPRING WASHER
308	RELEASE BRACKET	329	CONTACT ARM PIN
309	COVER		
310	ARC CHAMBER	* 331	STAT CONT ASSY. L.H.
311	TERM. CONN.	333	MOVING CORE
* 312	SPRING, CONTACT	* 334	SPRING, LATCH
* 313	SPRING, TRIP	335	PIN
* 314	SPRING, CONTACT ARM	336	LATCH
315	ELASTIC STOP NUT	337	GUIDE TUBE
316	LATCH PIN	* 338	OPERATING COIL
317	RELEASE BRKT PIN	339	MOLDED SPOOL
318	1/4-20X ⁵ / ₈ SCREW		
319	190-32X ³ / ₈ SCREW		
320	190X1/4 BINDING HD. SCR.		
			* REPAIR PARTS

FIG. 8 - Closing Relay

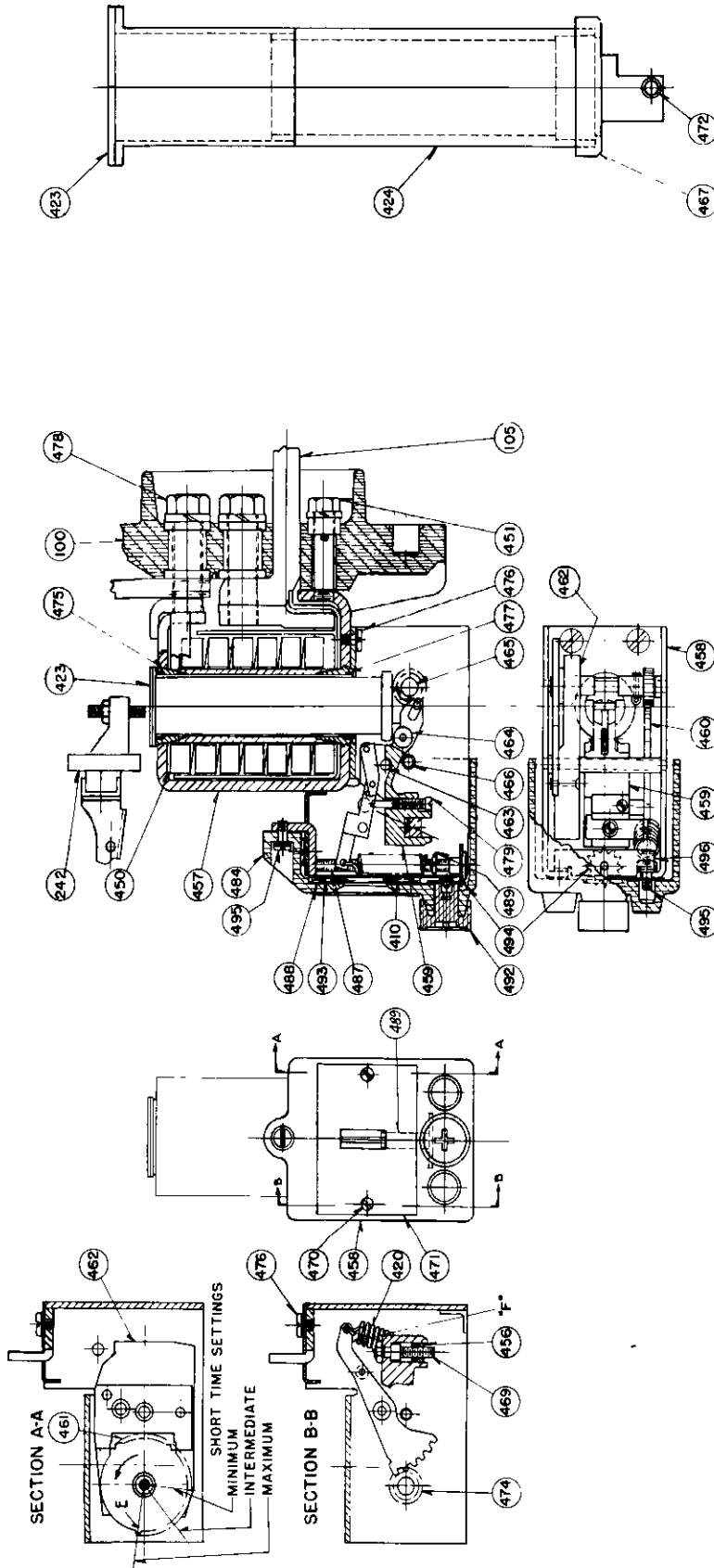


SECTION C-C

250	ANTI-SHOCK OPEN BRACKET
251	PIN
252	LEVER
253	PIN
254	PLATE
255	STUD
256	SCREW
257	WEIGHT
258	STUD

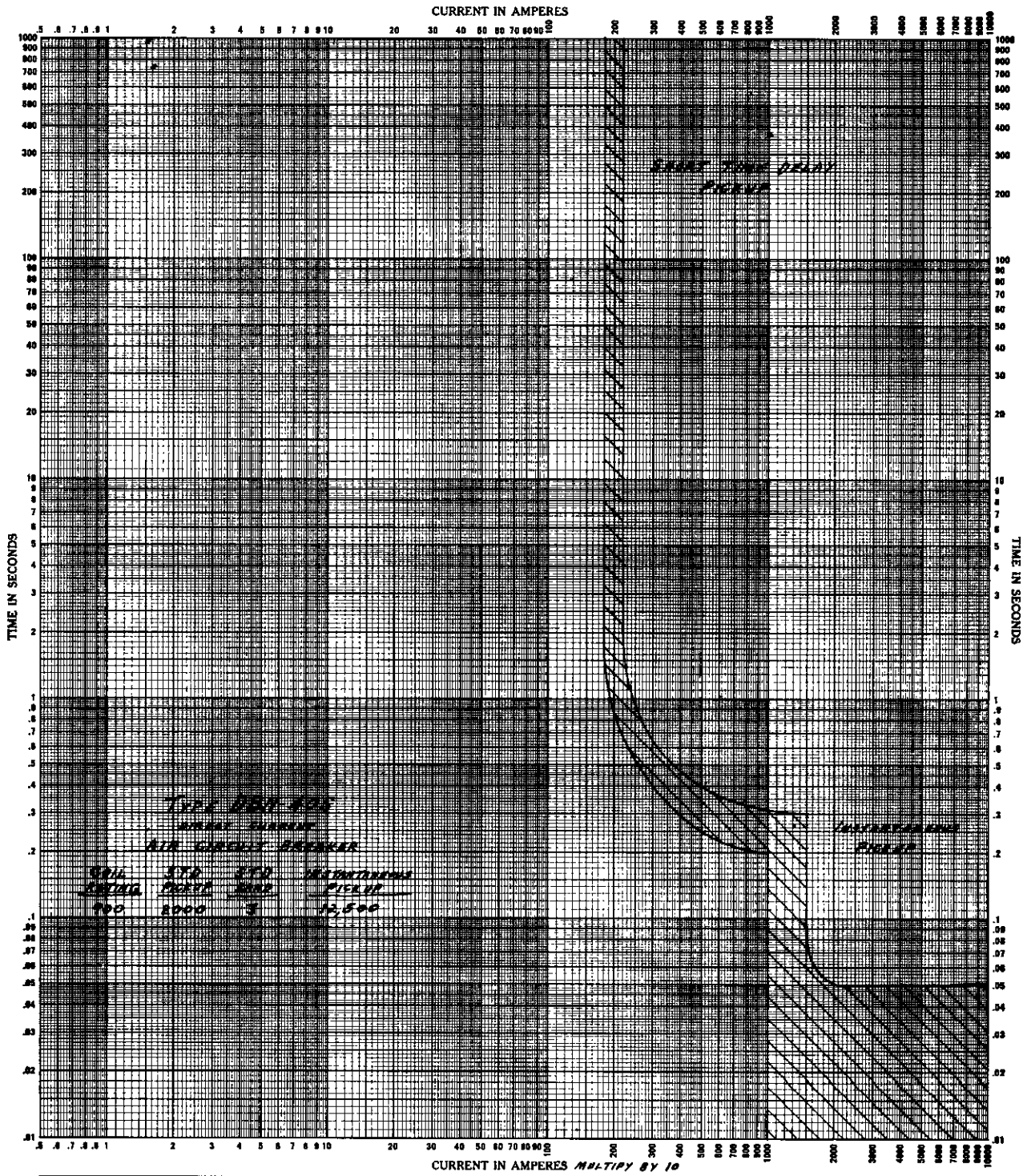
259	SPACER
260	SPACER
261	WASHER
*262	SPRING WEIGHT
*263	SPRING, PLATE
264	PIN
265	1/4"-20 ELASTIC STOP NUT
266	J64-32 X 1/4 FIL. HD. STL. MACH. SCR.
267	WEIGHT

FIG. 9 - Anti-Shock-Open Device



100 BASE	464 ROLLER	492 ADJUSTING KNOB
105 STUD	465 PIN	493 SCALE PLATE
242 TRIP FINGER	466 PIN	494 STAR GEAR
*410 SPRING CALIBRATION	467 END RING	495 SCREW
*420 SPRING INSTANTANEOUS	468 ADJUSTING SCREW	496 BRACKET BOTTOM
423 TUBE ASSY	470 1/2-40 X 1/4 T.C. SCR	423 TUBE
450 COIL CURRENT	471 NAME PLATE	424 LOWER CORE
451 3/8-16 X 1-1/2 S. BOLT	472 PIN	
456 ARM	474 PINION	
457 YOKE	475 UPPER YOKE RING	
458 HOUSING	476 1/90-32 X3/8 PAN HD S.M. SC.	
459 TOGGLE & LEVER ASSY.	477 LOWER YOKE RING	
460 GEAR SEGMENT	478 1/2-13 X 1-7/8 S. BOLT	
461 OSCILLATOR WHEEL	479 SCREW	
462 OSCILLATOR	484 MOLDED COVER	
463 PIN	487 CALIBRATION SCREW	
	488 TRANSPARENT COVER	
	489 INDICATOR	
	492 ADJUSTING KNOB	
	493 SCALE PLATE	
	494 STAR GEAR	
	495 SCREW	
	496 BRACKET BOTTOM	
	423 TUBE	
	424 LOWER CORE	
	*REPAIR PARTS	

FIG. 10A - Series Overcurrent Trip Device



DBN-405 D.C. TRIP TIME-CURRENT CHARACTERISTIC CURVES

For *G.O. MN-47972-Y* S.O. *31-Y-6258* Fuse Links In..... Dated.....

BASIS FOR DATA Standards.....

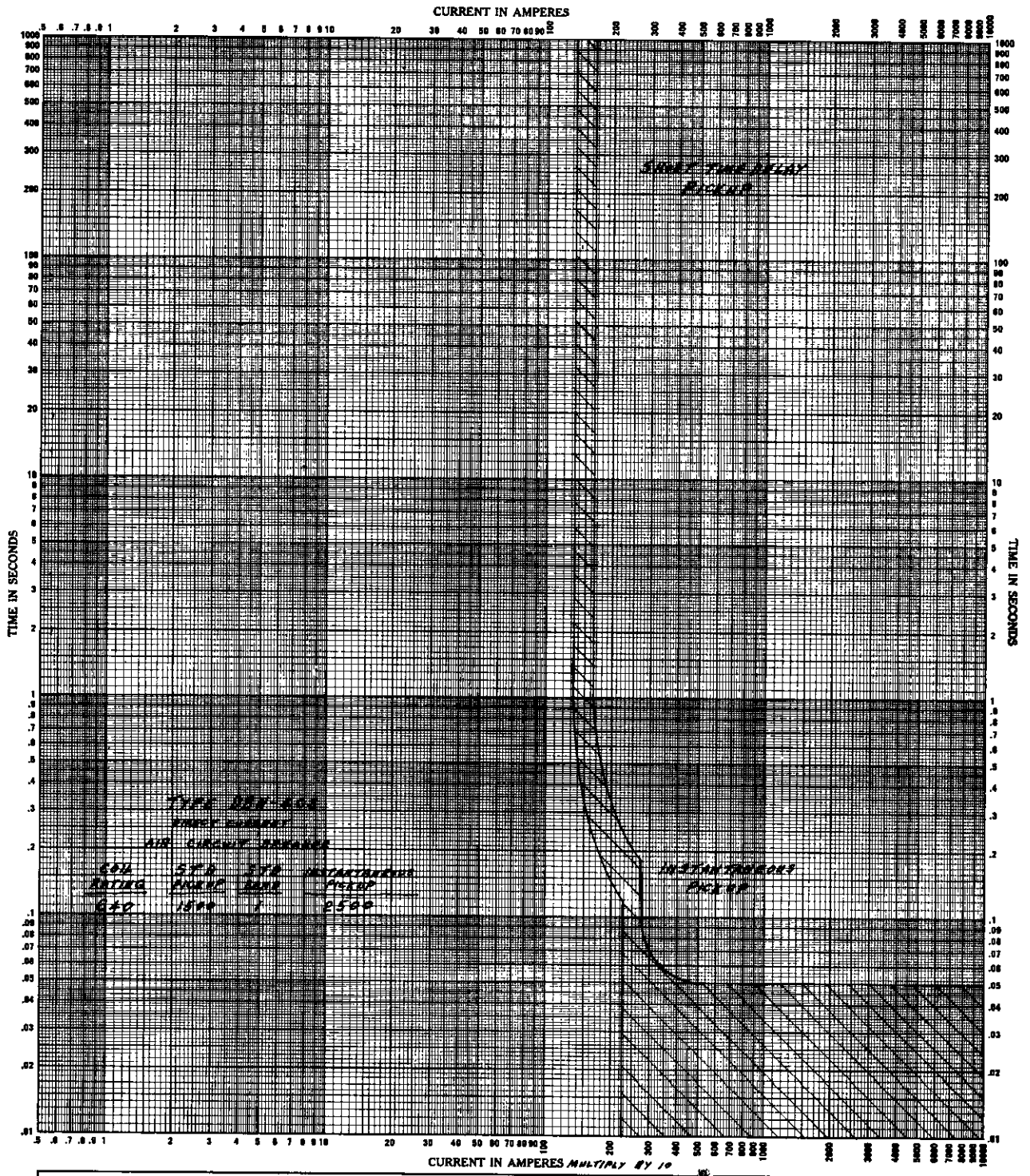
1. Tests made at..... Volts a.c. at..... p-I, Starting at 25C with no initial load

2. Curves are plotted to..... Test points so variations should be.....

No. *36240B*
Date *FEB. 10, 1953*

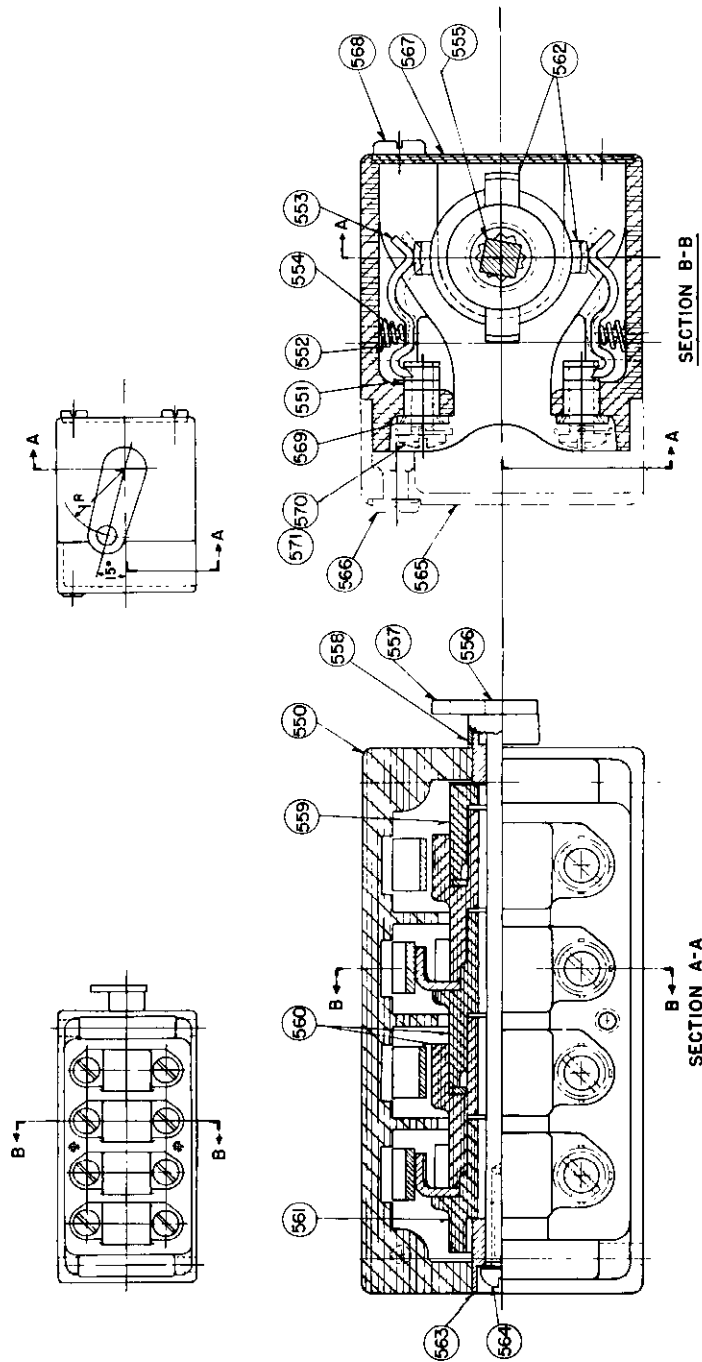
G.A. GILLENWATER

FIG. 10B - Overcurrent Trip Curve



DBN-405 O.G. TRIP		TIME-CURRENT CHARACTERISTIC CURVES	H. A. N.
For G.O. NH-47972-7		S.O. 31-Y-6857	G.A. GILLENWATER
BASIS FOR DATA Standards		Dated	
1. Tests made at		Volts a.c. at	p.f., Starting at 25C with no initial load
2. Curves are plotted to		Test points so variations should be	
		No. 362409	Date

FIG. 10C - Overcurrent Trip Curve



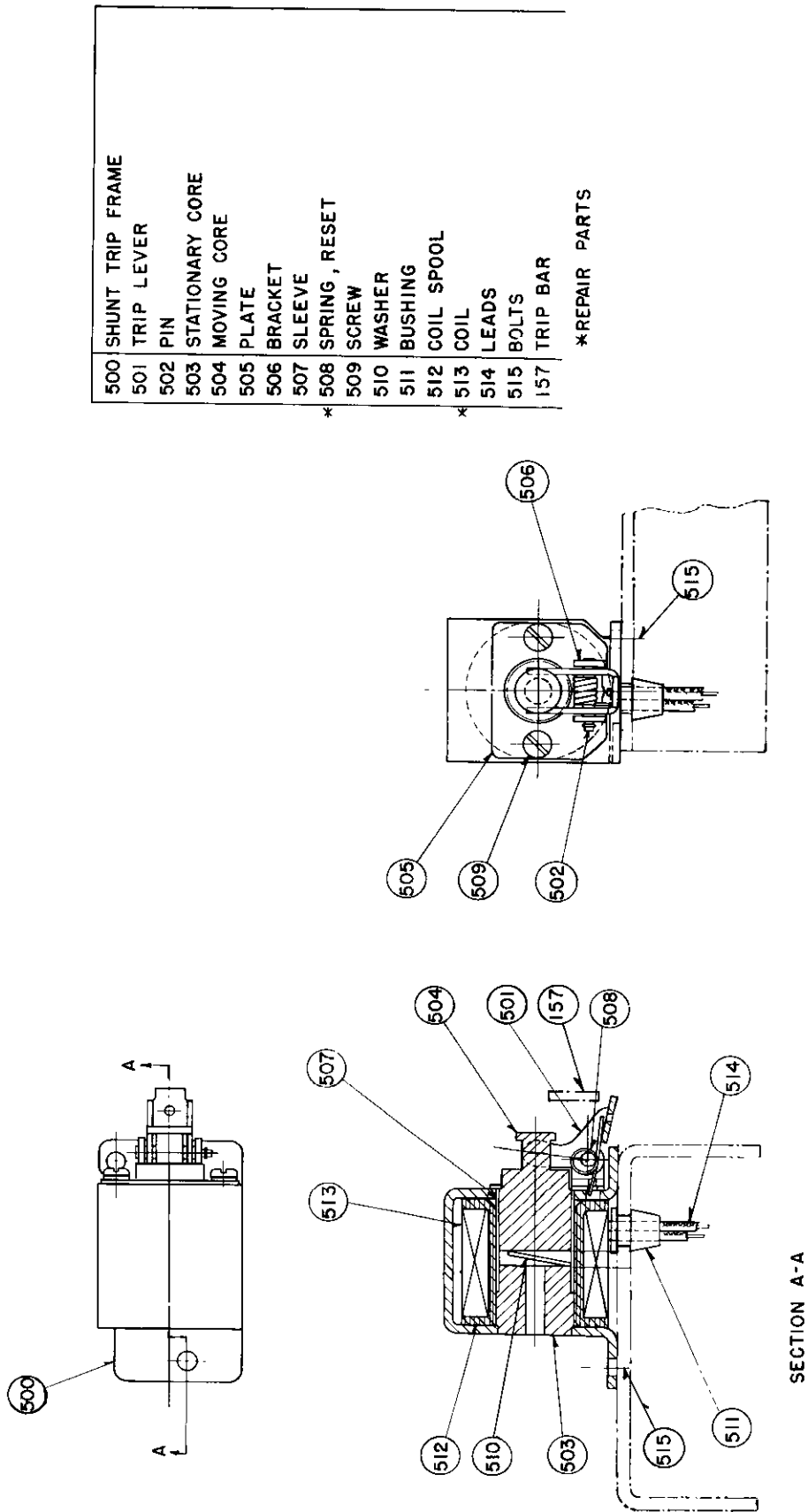
-AUXILIARY SWITCH-

561	ROTOR END
562	CONTACT
563	BUSHING
564	.190-32 X 1/2 RD. T. C. SEMS MACH. SCR
565	COVER
566	.164-32 X 3/4 PAN BL. STL. SEMS MACH. SCR.
567	COVER
568	.164-32 X 3/8 PAN T. C. BL. STL. MACH. SCR.
569	COLLAR
570	.164-32 X 1/2 BD. SI. BRZ. MACH. SCR.
571	CRIMP WASHER

* 550	AUXILIARY SWITCH
551	STEM
552	CONTACT SPRING
553	CONTACT FINGER
554	RIVET
555	SHAFT
556	SHAFT END
557	ARM
558	SPACER
559	ROTOR END
560	ROTOR SECTION

* REPAIR PARTS

FIG. 11 - Auxiliary Switch



500	SHUNT TRIP FRAME
501	TRIP LEVER
502	PIN
503	STATIONARY CORE
504	MOVING CORE
505	PLATE
506	BRACKET
507	SLEEVE
* 508	SPRING, RESET
509	SCREW
510	WASHER
511	BUSHING
512	COIL SPOOL
* 513	COIL
514	LEADS
515	BOLTS
157	TRIP BAR
*REPAIR PARTS	

FIG. 12 - Shunt Trip Device